



US009358003B2

(12) **United States Patent**  
**Hall et al.**

(10) **Patent No.:** **US 9,358,003 B2**  
(45) **Date of Patent:** **Jun. 7, 2016**

(54) **ELECTROMECHANICAL SURGICAL  
DEVICE WITH SIGNAL RELAY  
ARRANGEMENT**

(58) **Field of Classification Search**

USPC ..... 700/251, 250, 245, 258; 227/175.1,  
227/156; 606/130

See application file for complete search history.

(71) Applicant: **Ethicon Endo-Surgery, Inc.**, Cincinnati,  
OH (US)

(56) **References Cited**

U.S. PATENT DOCUMENTS

66,052	A	6/1867	Smith
662,587	A	11/1900	Blake
670,748	A	3/1901	Weddeler
951,393	A	3/1910	Hahn

(Continued)

FOREIGN PATENT DOCUMENTS

AU	2008207624	A1	3/2009
AU	2010214687	A1	9/2010

(Continued)

OTHER PUBLICATIONS

International Search Report for PCT/US2014/018241, dated Aug. 7,  
2014 (6 pages).

(Continued)

*Primary Examiner* — Ronnie Mancho

(57) **ABSTRACT**

A surgical instrument configured to relay a low-power signal from an end effector to a remote device is disclosed. The surgical instrument may comprise a handle, a shaft extending distally from the handle, and an end effector attached to the distal end of the shaft. A sensor may be disposed in the end effector. The sensor may generate a signal indicative of a condition at the end effector. A transmitter may be located in the end effector. The transmitter may transmit the signal from the sensor at a first power level. The signal may be received by a relay station located proximally to the shaft. The relay station is configured to retransmit the signal at a second power level, wherein the second power level is higher than the first power level.

**20 Claims, 99 Drawing Sheets**

(65) **Prior Publication Data**

US 2014/0246474 A1 Sep. 4, 2014

(51) **Int. Cl.**

**G05B 15/00** (2006.01)

**G05B 19/00** (2006.01)

**A61B 17/068** (2006.01)

**A61B 17/072** (2006.01)

**A61B 18/14** (2006.01)

**A61B 17/00** (2006.01)

(52) **U.S. Cl.**

CPC ..... **A61B 17/068** (2013.01); **A61B 17/07207**  
(2013.01); **A61B 18/1445** (2013.01); **A61B**  
**2017/00017** (2013.01); **A61B 2017/00022**  
(2013.01); **A61B 2017/00115** (2013.01); **A61B**  
**2017/00221** (2013.01); **A61B 2017/00398**  
(2013.01); **A61B 2017/00482** (2013.01); **A61B**  
**2017/00734** (2013.01)

